STRUCTURING A SUCCESSFUL INFORMATION TECHNOLOGY TRANSFER PROCESS: A CASE STUDY FROM THE PERSPECTIVES OF ACTOR NETWORK THEORY

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ABSTRACT

An efficient and effective information technology transfer from developed countries to Malaysia is an important issue as a prerequisite to support the ICT needs of the country to become not only a ICT user but also a ICT producer. One of the factors that influences successful information technology transfer is managing the process of how technology transfer occurs in one environment. It involves managing interaction between all parties concerned which requires an organized strategy and action toward accomplishing technology transfer objective in an integrated and effective mode. Using a conceptual framework based on the Actor Network Theory (ANT), this paper will analyse a successful information technology transfer process at a private company which is also a supplier of information technology (IT) products to the local market. This framework will explain how the company has come up with a successful technology transfer in a local environment. Our study shows that the company had given interest to its relationships with all the parties involved in the transfer process. The technology transfer programme and the strategy formulated take into account the characteristics of technology and all those involved.

Keywords: Information Technology Transfer, Actor Network Theory, Successful Information Technology Transfer, Managing Technology Transfer, Managing Interaction of Actors.

INTRODUCTION

Malaysia has no doubts that information and communication technology (ICT) can generate knowledge-based economy (k-economy). To develop k-economy, the country must have ICT capacities that are equivalent to those in developed nations. In relation to this, an efficient and effective information technology transfer from developed countries to Malaysia is an important issue as a prerequisite to support the ICT needs of the country to become not only a ICT user but also a ICT provider. There are several factors which influence successful information technology transfer. One of them is to organize a transfer process that involves many parties who have different objectives and many stages which require different strategies. This aspect was given less attention in the literature of technology transfer. This paper, therefore, intends to analyse how the information technology transfer process occurs based on a case study of a successful company. The analysis includes investigating the methods and the strategies used in managing the information technology transfer process. It is hoped the company's experiences become a guide for other companies in the future. The analysis process, based on the Actor Network Theory (Callon, 1986), shows how the technology transfer strategy and programme had been initiated on specific issues and domestic problems instead of being carried out according to generic needs.

THEORETICAL BACKGROUND

Technology transfer involves various dimensions and factors such as economic dimensions, social, political and organizational factors (Beilock & Dimitrova, 2003; Fagan, 2001; Walter, 2000). One of the factors is a process of how technology transfer occurs in one environment. This process involves different levels and for each level, there are different parties who play different roles with different objectives (Buxton & Malcolm, 1991). Technology transfer also requires cooperative activities from many individuals or functional units that are structurally and culturally different (Gibson & Harlan, 1995). According to Dudley (2006), there are two importance aspects in technology transfer: (i) the science and technology of technology transfer, and (ii) the working relationships between the parties involved in the technology transfer process. This means that the process and the interaction management between those parties depend on an organized strategy and action toward accomplishing technology transfer objectives in an integrated and effective mode.

Technology Transfer Process

Technology transfer process refers to the process of implementing technology developed from one context to another different context. The implementation

of technology needs a modification of the system, procedure, work flow and working culture of a new environment. Previous researches have shown that a successful process of technology transfer involves several activities such as planning (Madu, 1992), assimilation and use (Baark & Heeks, 1998), adaptation (Narasimhan, 1984; Lall, 1987; Schmitz & Hewitt, 1991), innovation (Quitas, 1994; Rogers, 1995), diffusion (Dooley, 1999) and evaluation (Cuyamaca Web Team, 1998). Technology transfer activities describe what happens in the technology transfer process.

Based on the nature of the activities, technology transfer activities are divided into three levels: (i) Pre-Technology of Transfer (Pre-TOT), (ii) Technology of Transfer Implementation (TOT Implementation) and (iii) Post-Technology of Transfer (Post-TOT) (Huda, 2006). This is also called a life cycle of IT Transfer. Pre-TOT is made up of activities associated with technology transfer planning such as requirements analysis, decision for technology acquisition, investigation on a suitable technology, identifying technology providers, recognizing possible cooperation, and necessary resources. Pre-TOT is critical to ensure that the whole process of technology transfer is efficient and effective. The weaknesses in the management and strategic planning has contributed to failure in technology transfer efforts (Capps et al., 2002; Honey, 1992).

The second level, TOT implementation, involves technology delivery and installation, assimilation and operation, maintenance, and assessment. Several problems could have occurred during implementation, such as those related to human resources, training, and weaknesses in supervision implementation (Chung, Lee & Chik 1997). Therefore, TOT implementation should be properly made. The last level (Post-TOT) is innovation and dissemination of technology, including innovation of new technology, research and development, creation of a sub-industry and a technology development centre, decision on technology dissemination, and sharing and dissemination of new knowledge. Post-TOT is important to support technology usage and product development according to local demand.

Each level of the technology transfer process involves many different actors who interact to each other to attain their objectives respectively. Actors include individuals, groups of individuals and non-human elements that represent various roles, such as technology recipients, technology messengers, employees, management, trainees, trainers, customers, partners and consultants. Non-human elements include technology, machines, business reports, documents, business strategies, policies, plans, and culture. Interactions between human and non-human elements might raise problems and conflict which will influence the success or failure of technology transfer.

The concept of the technology transfer process however, does not explain how the management of interactions between the actors at every level should be done to determine technology transfer efficiency and effectiveness. This paper, therefore, would use the actor network theory to analyse processes which occur at every level of technology transfer.

Actor Network Theory

Past research has shown that the process of technology transfer in the real world is not a linear and systematic process (Flannery & Dietrich, 2000). It involves various changes such as in the products' functions, human knowledge and skill, and behaviour and organizational culture (Jegathesan et al., 1997; Schnepp et al., 1990; Derakhshani, 1983). As technology transfer involves many agents and participants (Buono, 1997), it also requires involvement and interaction of many stakeholders from different levels of organization. Interaction between various stakeholders can influence the activities performed in the technology transfer process. In this study, we used the actor network theory (ANT) to study how interaction between the participant and the agent of technology transfer affect the technology transfer process. ANT is an approach which refers to how a network of actors is constituted through a diversity of human and non-human elements with a variety of roles, relationships and activities to meet the problems decided by the major actor (focal actor). The theory was first proposed by Michel Callon and Bruno Latour in the early 1980s (Callon & Latour, 1981; Callon, 1986) and reveals the world as networks of heterogeneous human and non-human actors with multiple roles, relations and activities (Latour, 1993). ANT utilizes powerful concepts such as actors, actor-network, translation, intermediaries, boundary objects, and obligatory passage points (OPP). Based on ANT, the potential implementation is in the hands of those who can convert problems and requirements to support the organization (Berntsen & Seim, 2007). The next section describes the details of the translation process in connection with several other concepts of ANT.

Translation Process

Translation, in fact, is a process that creates an actor-network (Sidorova & Sarker, 2001). It occurs when actors start to determine roles, distribute and redistribute roles and powers, and explain the scenario. Throughout these occurrences, alliances between human and non-human actors are formed and connected. Translation represents an interaction between the actors when they trust and negotiate among themselves. It is not the same as regular interaction since it focuses more on joint-determination between actors when

they communicate with each other. Translation involves a process of changes following four moments namely (a) problematization, (b) interessment, (c) enrolment, and (d) mobilisation.

Problematization requires the identification of the actors and the determination of the Obligatory Point of Passage **(**OPP). According to Callon (1986), OPP is a situation or a process that has to occur in order for all the actors to be able to achieve their interests, as defined for them by the focal actor. Problematization involves i) identifying the issue or problem, ii) recognizing the variety of actors, iii) identifying the roles and interests of each actor, iv) determining OPP in each level, and v) identifing potential obstacles (i.e. challenge, threat and pressure) toward achieving OPP. Such neglect to these obstacles would affect the achievement of OPP. In the creation of an actor-network, text and graphics representation will be produced to protect the interests and/or agreement between the actors. This writing process or interest or agreement is called inscription. It is intended to give away the programme's action to other actors which might be complied or not.

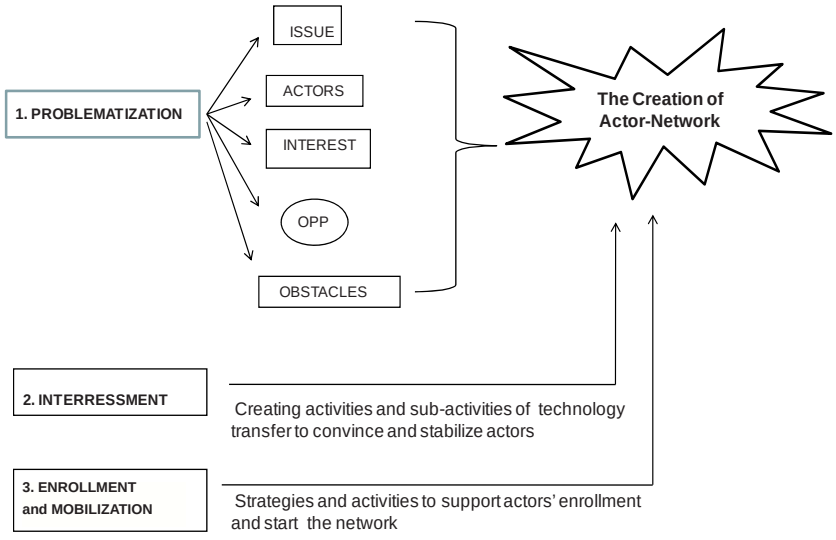

Figure 1. The Creation of an Actor Network

Following problematization is the Interressment moment. It is a group of actions where the major actor tries to impose and stabilize the identity of

the other actors (Callon, 1986). Interessment is also about convincing other actors to accept the roles given by the major actor through a creation of an interressment mechanism, or activities that promote cooperation between the actors to face obstacles in order to achieve OPP. The next moment is enrolment, a situation where the actors accept the interest determined for them by the major actor. Similar to interessment, this moment sees the formation of some efforts (enrolment mechanism) to build and strengthen the actors to face obstacles, which eventually creates an actor network. The enrolment mechanism includes a strategy or a set of activities, for instance, negotiation with different parties, strengths and tricks to support the enrolment of an actor in the actor network of technology transfer. The final moment is mobilization, an effort to get the network to start operating strategies. A set of methods is needed to ensure those who become the spokespersons have the capability to represent cooperation and not refuse. Figure 1.0 shows the four moments in the creation of an actor-network.

Research Approach

This article intends to study the experiences of a technology transfer case study. The analysis of the case study is made based on the framework given in Table 1.

Past experience has shown that an efficient and effective technology transfer should focus on several phases categorized as Pre-TOT, TOT implementation and Post-TOT. Pre-TOT is necessary so that the organization can prepare and set up an action plan to acquire new technology while TOT implementation is important to be carried out efficiently and effectively. Post-TOT is essential to encourage technology development and adaptation with the current situation and needs.

From ANT perspectives, each phase would involve variations in an organization, which will bring to an efficient and effective technology transfer. At Pre-TOT level, an organization changes from an unprepared to a prepared level in acquiring a new technology. At TOT implementation phase, the organization moves from having no new technology to possessing a new technology whilst at Post-TOT level, the organization is advancing to modifying and disseminating the use of that technology. In order to realize the changes at every level, the management of technology transfer should give focus to aspects such as problematization, interessment, enrolment and mobilization.

Table 1

Framework to Analyse Technology Transfer Process

	TOT Phases	**Phase-1: Pre-TOT**	**Phase-2: TOT Implementation**	**Phase-3: Post-TOT**
ANT Concepts	*Problematization*	Issues	Issues	Issues
		Actor	Actor	Actor
		Interest	Interest	Interest
		OPP	OPP	OPP
		Obstacles	Obstacles	Obstacles
	Interessment	Interessment Mechanism: Activities of technology transfer	Interessment Mechanism: Activities of technology transfer	Interessment Mechanism: Activities of technology transfer
	Enrolment & Mobilisation	Enrolment Mechanism and 'Mobilisation': - Strategies - Intermediaries'	Enrolment Mechanism and 'Mobilisation': - Strategies - Intermediaries'	Enrolment Mechanism and Mobilisation: - Strategies - Intermediaries

Data for this study was gathered by carrying out personal interviews based on structured questionnaires. Three executive officers of XY Company were interviewed. The questions in the interview were divided into five sections: (i) A company profile, (ii) the planning process and decision making before a new technology was transferred to the company, (iii) the implementation of the actual technology transfer, (iv) the post activities and future planning after the technology has been transferred to the company, and (v) issues, challenges and actions taken by the company during the whole process of technology transfer. To support the interview section, the study also relied on secondary data gathered from the company's library, which included the company's annual report, the company's newsetter, press releases, information of the company's vision, mission, business units, and the company's leadership, history and milestones.

Data from the interviews was recorded and was analysed based on TOT phases and from the perspectives of ANT. To support the data analysis and the interpretation, the study applied the concept of translation from ANT to the three phases of TOT. As shown in Table 1, translation was applied to Phase 1 (Pre-TOT and Planning), Phase 2 (TOT Implementation), and Phase 3 (Post-TOT). Each translation on each phase of TOT involved three major moments: (a) problematization, (b) interressment, and (c) enrolment. These three moments explain the details of human and non-human interaction in all the three stages of TOT.

ANT was chosen to interprete and analyse the data in this qualitative study since it intended to understand the behaviour of the relevant actors in the process of TOT. ANT was the best choice since it provides a framework to help the study understand and describe the actors' actions and interaction in IT transfer. The use of ANT does not only identify the success and failure factors of a particular IT project but also goes beyond it by understanding the complex interactions associated between the factors (Walsham, 1997).

CASE PROFILE OF XY COMPANY

XY (not actual name) a real company, which was set up in the 1980s, is a private company that provides information and communication technology (hardware, software, knowledge and skills) to meet the needs of its customers. To fulfill this objective, XY has responsibilities to seek information on products, inform customers about the products, provide the products, modify the products according to customers' needs, give training to employees and customers, and deliver products, knowledge and skills, as well as ideas and business ventures to other parties. Together with these responsibilities, the company develops

business entrepreneurship and skills. Since its establishment, XY has been heavily involved in IT projects, at local and global levels. The vast experience the company has had through the projects has exposed it to a lot of knowledge in information technology transfer and development. The company, with 300 employees, has a vision to be among the top IT companies in Malaysia. It has involved it self so far in varieties of IT projects and products such as network, application development, maintenance services, asset management, and hardware. The focus of the business is on system integration and services, from network solutions to turnkey projects.

Compared to other IT companies, XY has shown some good practices in technology investment, technology implementation and technology transfer as a whole. Its success as one of Malaysia's local leading IT companies is partly due to the unique structures and cultures of its technology division and its innovative leadership style (MASTIC, 2007). This is also based on its experience and involvement in technology transfer project and honored prize received previously. There are a few factors that play a role in the success of the company such as:

- Human resource is the key success factor. Employees are structured according to groups. Every group is made up marketing officer, business manager and project leader. Most of the group members have professional qualification.
- A continuous collaboration between the company and business partners makes the company get support and priorities from external parties and outside knowledge to assist its customers.
- Company's capability in giving training through variety of educational services such as: a) instructor led classroom, b) hands-on exercises, c) reference-aid. Additional training resources and skill are from a) in-house training source, b) external sources such as technical consultant acknowledged in their own fields, c) external and well trained experts from a variety of IT fields.

ANALYSIS ON THE TECHNOLOGY TRANSFER PROCESS IN XY COMPANY- FROM ANT PERSPECTIVES

In total, the technology transfer process has the same purpose, that is, to achieve efficient and effective technology transfer. This process involves several levels where each level relates to another and influences one another. However each TOT level has different issues and problems. In order to have a clear understanding on the problems that exists at every level, an analysis using ANT was made at every level of TOT process.

Verification on the accuracy of the outcome was made at three levels:

1. Identifying the existence of the three levels of TOT (based on the characteristics of activities). The existence was revealed by the interviews and references to documents related to the activities.
2. Existence of information in terms of ANT concepts by referring to information gathered during the interview and the company's documents.
3. Confirmation with the interviewees after data analysis.

Pre-TOT Level

Table 2 shows the summary of the application of the ANT concept at Pre-TOT level. Problematization: At this level, the issue or problem being focused is the lack of a particular technology to meet consumers' need. Actors at this level are customers (market), potential technology, technology provider or vendor (either local or overseas) and external organization. Each actor has its own interest. Customers, for instance, are looking out for a new solution to their problem, while a potential technology offers solutions to XY, a technology provider wants to make sales and profit, engage in a new business and find a new partner. Different interests cause difficulties to achieve the target that is to fulfil the needs for a new technology by customers. XY becomes the 'focal actor' to seek technology to fulfil the customer's needs.

OPP: an issue of whether a new technology should be transferred to XY. In order to achieve this OPP, four obstacles or challenges were recognized:

a. to provide a solution to the customer in a given time;
b. to face a rapid change of information technology;
c. to produce low-cost and value-added solution; and
d. to manufacture marketable products or solution.

The challenges above create hesitation among the actors to be involved in the transfer of a new technology. The management of XY should take action to convince the actors through certain programmes and strategies that can encourage the actors to play their respective roles. As shown in Table 2, interessment mechanisms that are in the form of activities are recognized to face the given obstacles:

1. Activity 1: Identify and evaluate potential technology (obstacles i, ii, iii).
2. Activity 2: Perform market analysis to meet challenge (obstacles iv).
3. Activity 3: Decision making for technology transfer (obstacles i, ii, iii, iv).

Table 2

Analysis of Pre-TOT Level from ANT Perspectives

ANT Concept	Application of ANT concept			
ISSUE	Lack of a specific technology to fulfil customer's needs			
ACTOR	Technology	Technology provider	Customer (Market)	External organization
INTEREST	Solution to XY	Sales, profits and new business	Working solution	New Business and Partners
OPP	Should a new technology be transferred to XY?			
OBSTACLES	Time	Frequent changes	Good solution	Marketable product
INTERESSMENT MECHANISM	Activity 1: Identify and evaluate technology	Activity 2: Market analysis	Activity 3: Decision-making process	
	'STRATEGY'		**'INTERMEDIARY'**	
ENROLLMENT MECHANISM and MOBILISATION	Collaboration, Central repository System Sell-cycle strategy Flat-organization structure Open communication		Product information analysis, Human resource database Financial information, standard infrastructure, Collaboration analysis technology transfer (TOT) Implementation plan' Post-TOT Plan and decision-making results	

Furthermore, to support the implementation of the interressment mechanism towards achieving OPP, enrolment and mobilization mechanisms in the form of strategies are created. Among the strategies are cooperation, Central Repository System (CRS), Sell cycle-strategy and flat organization strategy (Table 2). Cooperation is implemented through a relationship with the technology provider. It is evidenced through the supplies of information of product specifications to the company by the provider. Cooperation is also done through an internal contact where XY workers directly ask for information from the vendors. Information is kept in the Central Repository System (CRS) to be shared and developed for further use. CRS has expedited information processing and decision making in the company as well as has encouraged employees to play their respective roles and react. Sell-cycle strategy supports market analysis in manufacturing marketable products. It involves negotiation, informal discussions and meetings between customers and XY. The company adopts a 'flat organization structure', an open communication policy practice that encourages workers at all level to communicate openly without any barriers.

The implemented strategies are stabilized again through several intermediaries such as product-information analysis, human resource database, financial information, standard infrastructure, cooperation analysis, 'TOT implementation plan', 'Post-TOT Plan' and decisions from decision making. 'TOT-implementation plan' describes technology transfer such as objective, expectation, duration, technology component, need and constraint. 'TOT Assessment Plan' represents XY's interest to control and evaluate the technology transfer implementation, while Post-TOT Plan represents the company's interest for technology development future.

Analysis of TOT Implementation Stage from ANT Perspective

After a decision is made to agree on technology transfer, the issue at XY now is on the need to implement technology transfer (Table 3). This is followed with the identification of actors and their interest. The new technology received at XY should be able to function as specified. It would be sold to clients after quality assurance. The interests of technology provider are- profit making, creating new business and cooperation from new sale as well as responsible for skill and knowledge development in XY. The employees of XY have interests to learn about the new technology including the characteristics of the technology, functions, capabilities and constraints.

Table 3

Analysis of TOT Implementation Stage from ANT Perspective

ANT Concept	The Application of ANT concept						
ISSUE	The need to implement technology transfer						
ACTOR	Technology	Provider	Employee	Trainer	Customer	Assessment Plan	External organization
INTEREST	New technology installation	Profit making, creating new business	Human resource development	Skill development program	Product	Product and skill assessment	New Business and Partners
OPP	XY's ability in dealing with technology transfer implementation						
OBSTACLES	Skill		Good solution		Change management		
INTERESSMENT MECHANISM	Activity 4: Technology acquisition and installation		Activity 5: Implementation of TOT Program		Activity 6: Technology operation	Activity 7: TOT Assessment and Monitoring	
	STRATEGY				INTERMEDIARIES		
ENROLLMENT MECHANISM AND MOBILISATION	Employee's commitment Continuous collaboration Training Strategy TOT Assessment Strategies				Purchase agreement, technology components, money Collaboration Agreement, TOT Implementation Plan, TOT programs and materials, knowledge and skills, user manuals Customers' requirements changes report, Changes approval and Assessment reports.		

Each actor will be having several different own ways to meet the needs to implement the transfer. Following that, XY as the focal actor should determine OPP to match the interests of all the actors. The OPP at this level is to ensure the ability of XY to manage technology transfer implementation. To achieve OPP, the actors face some obstacles:

1. XY, upon receiving new technology, does not have the expertise to use a new technology.
2. To give the best solution to realize the needs of the customer and the environment.
3. The change in the customer's needs resulting from the fast changes of the features aspect, function, the capacity of the hardware or the software. These barriers could cause uncertainty among the actors. The management in XY needs to invent actions, plans and strategies (interessment and enrolment mechanism) to overcome these barriers and persuade the actors to agree and cooperate.

The interessment mechanisms to face the obstacles are:

1. Activity-4: Technology acquisition and installation. This activity convinces actors to accept the role and interest to support the implementation of a new technology. This activity prepares the new technology to operate with the cooperation of XY and the technology provider.
2. Activity 5: Implementation of TOT Programme Action (obstacle i). To overcome this obstacle, the focal actor implements the TOT programme in the form of training strategy such as internal and external training programmes.
3. Activity 6: Technology operation (obstacle ii). Supported with two strategies: employee commitment and continuous cooperation in terms of information sharing with the customer and the technology provider. In giving good solutions to meet the customer' needs, the new technology has to be modified and adapted to a certain specification. In adapting the technology, employees have a chance to apply skills and knowledge acquired from Activity-5 to perform modification and enhancement. Adaptation involves negotiation and persuasion on the interests of employees, customers and technology. Interaction between the actors in Activity-6 involves documents as intermediaries, such as customers' needs, reports of changes in customers' requirement and the approval of the changes.

4. Activity 7: Assessment and monitoring (obstacle iii). This activity gives confidence to the actors to cooperate in managing change. This activity entails evaluating the progress of the TOT programme, potential changes, the changes in the customer's needs, and assessing the technology transfer impact on employee performance, business activity, and relationship with customers. Activity-7 is supported with two strategies:

    d. The TOT Assessment Plan and continuous cooperation. The TOT Assessment Plan provides guidance to monitor the progress of the TOT programme and makes changes when necessary; and
    e. The TOT Assessment Plan provides guidance to focal actor to the assess skill and employee knowledge based on instructional material and presentation, project proposal and completed works.

Analysis at Post-TOT Level from ANT Perspective

Using concepts from ANT perspective, this paper has identified the main elements involved in the process of translation at Post-TOT level (as in Table 4). The assessment of technology at the implementation level has identified a new issue which needs to be handled at Post-TOT level. The issue is recognized as the need for technology development in the future. If the customer's new requirement requires small changes, it could be fulfiled with some modification. However, major changes including a development of new technologies would be performed if there are needs for major changes. XY managed this issue by asking cooperation from major actors like technology, technology provider, XY employee, Post-TOT Plan and customer (Table 4). Post-TOT Plan had been developed from decision-making process at Pre-TOT level. Each actor has respective interest as stated in Table 4.

Each actor had a variety of ways to meet its interest. The focal actor responsed by creating a target (OPP) namely the issue of XY's capacity to fulfil the customer's solution in the future (Table 4). In order to meet this target, the actors faced some technical and non-technical obstacles such as getting useful and reliable information regarding forms and functions of future technology, rapid changes of IT, hawing a place in the market for a new product, producing produce value-added and in-time solution. These barriers have challenged XY to take part in future technology development through several interessement mechanisms namely Activity-8 (Technology innovation) and Activity- 9 (Technology diffusion). These activities are supported by suitable enrolment mechanism and mobilization strategies.

Table 4

The Application of ANT Framework at Post-TOT Level

ANT Concept		Application of ANT Concept				
PROBLEMATIZATION	ISSUE	Need for technology development in the future				
	ACTOR	Technology	Provider	Employee	Post-TOT Plan	Customer
	INTEREST	Satisfy current needs	Satisfy new needs	Provide the best solutions	Give guides for the development of the company's future	Find new business and business partner
	OPP	XY tries to fulfil customers' solutions in the future				
	Obstacles	Useful and reliable information	Rapid changes in IT and competitors	New entrants in market	Time constraints	Value-added solutions
INTERESSEMENT MECHANISM		Activity 8: Technology innovation			Activity 9: Technology diffusion	
		STRATEGY			INTERMEDIARIES	
ENROLLMENT MECHANISM AND MOBILISATION		Sell-cycle strategy, research and development, System Development Life Cycle(SDLC), Central Repository System, marketing strategy, knowledge diffusion strategy			Market analysis, product analysis, SDLC documents, skills and knowledge, individual consultants, a new product, Product Resell Plan, Advanced TOT Programmes.	

Activity-8 is Technological innovation. This activity creates an opportunity for an actor to access suitable and reliable information from the customer, produce products with more value-added features together with challenges from competitors and rapid changes in IT. The implementation of Activity-8 is guided by the Post-TOT Plan. This activity is also endorsed by strategies such as the Sell-cycle strategy and the research and development activity and the SDLC method. The Sell-cycle strategy is a continuous 'technology discussion' between XY and its regular customers. These strategies raise discussions and negotiations on a new product. The research and development activity and SDLC provide methodology and tools for technology development. In building a new product, XY has options to select; either internal development or outsourcing. The selection of the option depends on the promptness of that technology development, level of interest and investment, and the resources owned by XY. Internal development needs high commitment from the company's employees. However, it triggers knowledge sharing and diffusion in the company. This information is stored in the Central Repository System that acts as a knowledge-sharing system.

Input and output from Activity-8 are intermediaries which include market analysis, product analysis, SDLC documents, skill and knowledge, individual consultants, new products, product resell plan and Advance TOT Programes (Table 4).

Activity-9 is Technology diffusion. It is the interressment mechanism coined to convince the actor in supporting the entry of a new product in a suitable market. It involves knowledge and skill diffusion that would encourage new ideas and another round new of technology transfer. Several strategies for enrolment and mobilization are training and marketing strategy. Workers were sent for advanced training and courses according to their expertise and interest in other IT companies, government agencies, and higher learning institutions. Marketing strategy is to support entry into a market with the company guaranteeing to offer products and good services and, cooperation with other companies which possess good access in the market.

DISCUSSIONS

Information technology transfer in XY involves many actors including human (technology provider either local or foreign companies), customers (market), employees of XY, trainer, and non-human (technology to be transferred), organization (external organization), Assessment Plan, and Post-TOT Plan

(Table 5). Each actor has a different interest and the interest may change at different leves. For example, at Pre-TOT level, a customer has an interest to get a working solution while at TOT implementation level, the interest is to get a product and at Post-TOT level, the interest has developed to find a new business and a business partner. XY gives attention not only to technology to be transferred but also to all the other actors involved.

Table 5

Actors Involved and their Interest at Each Level of Technology Transfer

No.	Actors	Interest		
		Pre-TOT level	TOT implementation Level	Post-TOT level
1	Potential technology	Solution to XY	New technology installation	Satisfy current needs
2	Technology provider (local and foreign)	Sales , profit, new business	Need for change	Satisfy new needs
3	Customer (market)	Working solution	Product	Find new business and business partner
4	External organization	New business , Partners	Seeking new knowledge	New business , partners
5	Employee of XY		Human resource development	Provide the best solution
6	Trainer		Skill development programme	
7	Assessment Plan		Product and skill assessment	
8	Post-TOT Plan			Give guides for the development of company's future

At each level of the technology transfer process, XY has defined different issues and has identified different obstacles to deal with. The company has also designed different activities and strategies to deal with respective issues and obstacles taking into account the relevant actors involved (Table 6).

Table 6

Different Issue, Obstacles and Activities and Strategies Adopted by XY at Various Level of Technology Transfer

Level	Issue defined by XY	Obstacles	Activities	Strategy used to carry out activities
Pre-TOT	Lack of a specific technology to fulfil customer's needs	Time, frequent changes, good solution, marketable product	-Identify and evaluate technology -Market analysis -Decision making process	-Collaboration -Central Repository System -Sell-cycle Strategy, -Flat-organization Structure, Open Communication.
TOT Implementation	The need to implement one technology transfer	Skill, good solution, change management	-Technology acquisition and installation -Implementation of TOT Programme -Technology operation -TOT assessment and monitoring	Employee's commitment, continuous collaboration, training, TOT Assessment strategies.
Post-TOT	Need for technology development in the future	Useful and reliable information, rapid changes in IT and competitors, new entrants in market, time constraints, value-added solutions	-Technology innovation -Technology diffusion.	Sell-cycle strategy, research and development, System Development Life Cycle(SDLC), Central Repository System, marketing strategy, knowledge diffusion strategy.

Our study shows that it is very important to take into account the local factors in designing technology transfer activities and strategies. They are the actors involved, issues perceived by XY and the obstacles faced by XY. Different situations of technology transfer will have different characteristics. This is why a successful application of the same technology in an organization may not be effective in another organization. The same technology transfer programme may not work in another organization because it involves different sets of actors, different issues and different set of obstacles. Based on the local situation, XY identified the actions that needed to be done in terms of a set of relevant activities, strategies and relevant mechanisms to carry out the activities which would encourage all the actors and the technology to play their roles in a coordinated manner.

CONCLUSIONS

Our study has found that XY had given attention to all the three levels in the technology transfer process practiced by the company. Pursuing the processes at every level, the company had also put consideration on four aspects namely problematization, interessement, enrolment and mobilization. This means that the transfer process activities were made and how the activity was made have led to the success of the technology transfer process in XY Company.

This study has shown the importance of addressing the aspects of planning, implementation and innovation, and technology diffusion when getting involved in technology transfer. Experiences of XY have also highlighted the needs to understand the issues, problems and obstacles faced in seeking new technology. Furthermore, all the parties involved should be identified and their roles determined. The management should ensure that thay continue to activly pursue their roles. There is a need for encouragement and supporting facilities to work on the roles. The management must be proactive to think of the strategy and the mechanism that could intrigue each actor to continue carrying out their respective roles. For each barrier that has been recognized, attention should be given and dealt with suitable strategies and mechanisms. In conclusion, the ANT approach is found useful in explaining how a successful technology transfer is managed especially to increase cooperation among the different parties involved in the technology transfer process.

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